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PRODUCTS REVIEWED

Wheatfield Audio HA-2 Headphone Amp

Reviewed by Charles Hansen & Betty Jane & Richard Honeycutt

PHOTO 2: Amplifier rear view.

PHOTO 1: Amplifier front view.

Wheatfield Audio LLC, 21715 W. 29th St. N., Andale, KS 67001, 316-641-6201, www.headphoneamp.com, e-mail pete@headphoneamp.com. Distributed by HeadRoom (800-828-8184, www.headphone.com). $695. Dimensions: 13″W × 8.5″D × 8″H (including tubes); net weight: 16 lbs. Limited one-year warranty (tubes 6 months).

The HA-2 is distributed by HeadRoom, a manufacturer of solid-state headphone amplifiers. I used a HeadRoom module in my preamplifier project (*AE* 6/97, p. 8), so I was curious to see how it compared with the HA-2. I use Grado SR-125 headphones (32Ω), so I needed to borrow a pair of 270Ω Sennheiser headphones to match the minimum 100Ω impedance required by the HA-2.

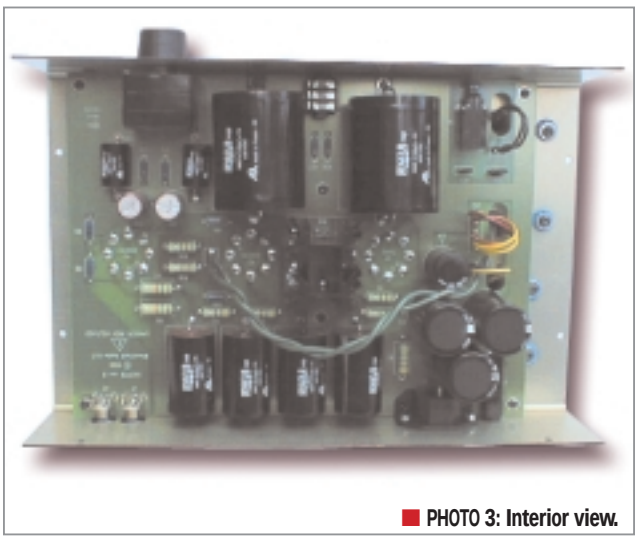

PHOTO 3: Interior view.

CONSTRUCTION

The Wheatfield Audio HA-2 is a single-ended tube headphone amplifier. *Photo 1* shows the front panel, which has the volume control, ¼″ headphone jack, and push-button power switch. There are no LEDs. Only the glow of filament and heaters serves as a power-on indicator.

The volume control has an expanding sweep graphic silk-screened on the black-painted aluminum chassis. Two oak strips sit beneath the chassis in which the rubber feet are mounted. Holes are provided around the tubes, on the bottom plate, and at both sides to enhance cooling.

The rear panel (*Photo 2*) includes a power fuse post, the IEC power receptacle, and a pair of cadmium-plated RCA input jacks. The third pin of the AC receptacle is connected to the chassis. Since the HA-2 has only a single set of input jacks—without pass-through output jacks—you must dedicate your audio source to it. Another alternative is to connect the HA-2 to your preamp tape loop.

Photo 3 shows the amplifier with the bottom cover removed. All the circuitry is mounted on a large PC board with heavy ground traces. The only wiring is from the power transformer and choke to the circuit board.

The unit is furnished with a heavy power cord. Workmanship is first-rate. The film capacitors are potted Angela MKP polypropylene, and the electrolytics are Panasonic and Elna Cerafine, while the resistors are Riken-ohm carbon film, and the tube sockets are silver-plated.

TUBE-POLOGY

The HA-2 circuitry is similar to a cathode-follower output preamplifier, except that the output impedance is low enough to drive headphones. The selected input

signal is applied to an Alps Black Beauty 100k dual audio pot. The wiper for each channel is connected to the grid of half a 6SN7 triode. The plate of the first stage is connected directly to the grid of a 6AS7 second stage, which is configured as a cathode follower, so the output is inverted.

The cathode sits at +190V DC and is loaded with a 2k 20W TO-220 power resistor mounted on a hefty finned heatsink. The AC output signal is coupled to the output jack through a 47µF capacitor loaded with a 4k7 output resistor. There is no global feedback.

Wheatfield recommends that the headphone impedance be 100Ω or higher to avoid higher distortion levels. That eliminates the Grado line, which has 32Ω nominal impedance. The power supply is full-wave rectified by a 5U4 and applied to a capacitor-choke pi-filter. A 6.3V AC winding, with two grounded fixed resistors to null the hum, powers the triode heaters.

Wheatfield Audio supplied the following tube complement with the review HA-2:

- Russian National Electronics 6SN7GT
- G.E. JAN 6080WC (6AS7G)
- Sovtek 5U4G

MEASUREMENTS

I installed the tubes and ran both channels with pink noise at 1V RMS for one hour into 270Ω. The unit runs fairly hot—more like a power amplifier than a preamp. The input impedance measured 91k. The output impedances for both channels measured 145Ω at 1kHz, and the HA-2 inverts polarity.

The HA-2 showed unity gain into 270Ω when the volume control was set at approximately 1 o'clock. I made all the measurements at a volume setting corresponding to 1V RMS output with a 0.5V RMS test signal (6dB gain). There was a very low level of hum in the headphones, independent of the volume control setting. There was no additional sound during either power-up or shutdown.

I recorded the response for loads of 620Ω, 270Ω, 100Ω and, out of curiosity, at the 32Ω load represented by Grado headphones. Remember that this low a load, while not harmful, is not recommended. The 47µF output coupling cap will roll the low frequency off –3dB at $f = 1/(2\pi RC)$.

The HA-2 frequency response measured within ±3dB from 5.5Hz to 60kHz, with 0dBr defined as 1V RMS at 1kHz into 620Ω, and –1dB down at 10Hz. When I decreased the load to 270Ω, the –3dB point rose to 8.5Hz. At 100Ω, –3dB crept up to 14Hz. As expected, with 32Ω it was down –3dB at 17Hz. This indicates that the actual value of the output coupling cap was higher than nominal, with very low ESR. High-frequency response rolled off gradually above 30kHz, and was down –3dB at 61kHz regardless of load, with no additional HF gain peaking.

The HA-2 provides a maximum of 16.8dB gain with a 620Ω load. Full-volume gain decreased to 14.8dB with 270Ω, and to 11dB for a 100Ω load. Volume control tracking was excellent, with no measurable difference for output voltages from 50mV to 2V RMS.

The HA-2's square wave response was very good. The 1kHz and 10kHz response showed a very slight rounding of the leading edges, with no tendency toward peaking or ringing. The 40Hz square wave showed some tilt, which increased as the load decreased, as a result of the limited low-frequency response caused by the output coupling capacitor.

DISTORTION

As with most tube gear, the HA-2 never really goes into hard "brick wall" clipping. The peaks of the waveform are softly compressed with increasing output voltage. Distortion does increase with decreasing load, however. The left-channel distortion was higher than the right, and is presented here and in *Table 1*.

The CCIF intermodulation distortion (19 + 20kHz) at 2.84V pk-pk into 620Ω was a low 0.007%. As I decreased the load to 270Ω, then 100Ω, the IMD increased to 0.36% and 0.97%, respectively.

Figure 1 shows THD+N versus output voltage into various loads at 1kHz, including the not recommended 32Ω and an open circuit (100k test instrument input impedance). Interestingly, the THD+N curves at 20Hz and 20kHz (not shown) were essentially the same as the 1kHz curves at each load. I engaged the test set 80kHz low-pass filter to limit the out of band noise. The 1% THD+N clipping voltage was 10.2V RMS for 620Ω, 4.27V RMS for 270Ω, and 0.95V RMS for 100Ω. Based on the residual distortion waveform I observed, power-supply hum and

TABLE 1
MEASURED PERFORMANCE

PARAMETER	MANUFACUTURER'S RATING	MEASURED RESULTS
Output impedance	100Ω	145Ω
Maximum output level (1kHz, 5% THD)	620Ω load: 13V RMS, 36V pp 270Ω load: 10.5V RMS, 30V pp	12.5V RMS 9.4V RMS
Maximum output power (1kHz, 5% THD)	620Ω load: 270mW 270Ω load: 400mW	252mW 327mW
Total harmonic distortion + noise (1kHz, 1V RMS output)	620Ω load: <TBD% (sic) 270Ω load: <TBD% (sic) 100Ω load: N/S	0.16% 0.22% 1.1%
Voltage gain	620Ω load: 17dB 270Ω load: 15dB 100Ω load: N/S	16.8dB 14.8dB 11.0dB
Frequency response (±3dB)	620Ω load: 10Hz–75kHz 270Ω load: 15Hz–75kHz 100Ω load: N/S	5.5Hz–61kHz ±3dB 8.5Hz–61kHz ±3dB 14Hz–61kHz ±3dB
Ripple and noise	<3.5mV RMS	1.9mV RMS
IMD-CCIF (19 + 20kHz)	N/S	270Ω load: 0.36%
Input impedance	N/S	91k
Power requirements	100W	

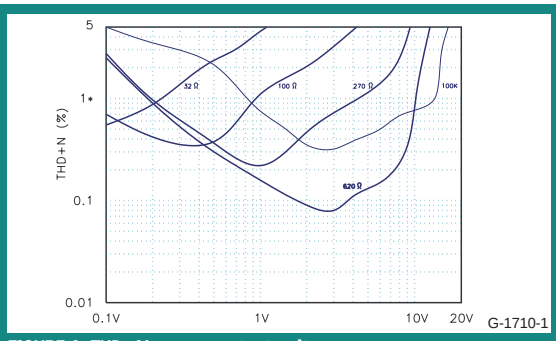

FIGURE 1: THD+N versus output voltage.

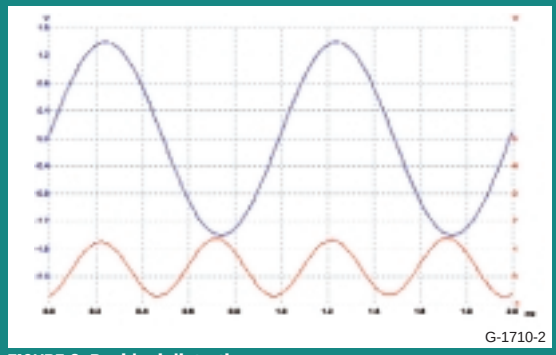

FIGURE 2: Residual distortion.

FIGURE 3: Spectrum of 50Hz sine wave.

some HF noise dominate the readings at low levels.

The distortion waveform for 1V RMS into 270Ω at 1kHz is shown in *Fig. 2*. The upper waveform is the amplifier output signal, and the lower waveform is the monitor output (after the THD test set notch filter), not to scale. This distortion residual signal is the second harmonic, with a low-level higher frequency riding on the waveform. THD+N at this point is 0.22%.

The spectrum of a 50Hz sine wave at 1V RMS into 270Ω is shown in *Fig. 3*, from zero to 1.3kHz. The THD+N again measured 0.22%, with the second harmonic measuring –56dB. The few higher harmonics present are all below –90dB. There are some power-line-related harmonics: 120Hz at –61dB, and 180Hz and 240Hz at about –85dB. ❖

(mfg. response on page 62)

CRITIQUE

Reviewed by Betty Jane and Richard Honeycutt

I believe it is in Derek Williamson's *The Complete Book of Pitfalls* that those young men who would impress their girlfriends with their stereo systems are advised to follow certain rules, including having at least one box with glowing tubes on top and a large knob on front. Wheatfield Audio has passed that test. The physical appearance of their HA-2 headphone amplifier is classic, to use the company's own words.

For old audio buffs like myself, certain warm fuzzies accrue from just plugging the tubes into the beautiful ceramic sockets, then turning on the set and seeing the glow. The solid feel of the chassis and the almost inaudible sound from the transformer vibrating the chassis also add to the familiarity. (The manufacturer uses synthetic vibration isolators to mount the power transformer in order to minimize mechanically generated buzz—an extra touch of quality!)

With that said, I must state that after 30 years of professional listening as musician, recording engineer, radio station engineer, and designer of loudspeakers and sound systems, I have learned that you must be especially careful how you listen if you are to hear what's there, rather than what you expect. I have learned that listening to just one product by itself will reveal obvious defects, but not much more. In comparative listening, it has been proven that a 1dB difference in level between two signals is not perceptible in terms of loudness, but will influence the vast majority of listeners to prefer the sound of the louder source. (This is an example of the Fletcher-Munson curve, in case you're interested.)

TESTING

In order to audition the HA-2 fairly, I set up an A/B box, connecting my CD player to both the HA-2 and a Sony TCWR565 cassette recorder. (The Sony has an integrated-circuit headphone amplifier that measures ruler-flat over a frequency range greater than that of my headphones). I fed the headphone output of the Sony to one input of the A/B box, and the output of the HA-2, to the other.

Then I played the 0dB, 1kHz reference tone on the *Hi-Fi News* test CD and trimmed the input level control of the Sony to balance the channels and to set the output at the reference level of the tape recorder. Finally, I set the output levels on the Sony and the HA-2 to provide 200mV at the output of the A/B box, while the output was feeding a set of Jensen 200 professional headphones. Output levels from the two sources were matched within 0.1dB.

The actual tests occurred with each of us working independently, listening to the tracks on the test CD while flipping the switch at will. We recorded our responses according to switch position A or B, and did not check which switch position corresponded to which source until the test was completed. Thus it was a blind A/B test.

In order to eliminate any "equipment bias" that might have resulted from a contaminated connector or switch contact, we swapped plugs after completing the tests and listened to track 1 again. We were able to correctly identify which switch position corresponded to the former "source A," thus proving that the differences we heard were not due to artifacts of the A/B box.

Only after each of us had completed the test did we identify which source corresponded to which switch position, and only then did we compare our results. Here is what we heard, identified by program material and listener initials. Please bear in mind that all the differences we heard were very slight, sometimes requiring many flips of the A/B switch to be sure.

TRACK 1—"LA REJOUISSANCE"/HANDEL
BJH: No discernible difference.
RH: The brass may have been slightly better defined on the control amplifier, but it was a close call. (Personal opinion: the arrangement and recording on this track overdo the percussion and fireworks noises for effect, making musical judgments difficult. The Jean-Francois Paillard recording on MHS 511 is superior. Familiarity with it could well have biased our expectations on this track.)

TRACK 2—"JERUSALEM"/PARRY
BJH: No discernible difference.
RH: Voices may have been a bit better defined on the control amplifier.

TRACK 3—"HENRY V" EXTRACT/DOYLE
BJH: No discernible difference.
RH: No discernible difference.

TRACK 4—"TRUMPET CONCERTO IN C"/VIVALDI
BJH: No discernible difference.
RH: No discernible difference.

TRACK 5—"PETER AND THE WOLF"/PROKOFIEV
BJH: No discernible difference.
RH: If there was a difference to be heard anywhere, it was on this track. Note the "if," though. Any difference was still quite subtle. But the voices, clarinet, and strings seemed ever so slightly fuller on the control amplifier, and the inner voices a bit more detailed. The trumpet may have had a very slight edge on the HA-2.

TRACK 7—"WELCOME, WELCOME"/PURCELL
BJH: No discernible difference.
RH: The inner voices may have been a bit more detailed on the control amplifier.

TRACK 8—MAHLER 8, "GLORIA PATRI DOMINO"
BJH: No discernible difference.
RH: Extreme highs may have been a bit more natural on the control amplifier.

TRACK 15—XYLO: PEOPLE WHO HIT THINGS, "THE WHISTLER"
BJH: No discernible difference.
RH: Higher pitches on the xylophone were better-defined on the HA-2, and the attack of the xylophone slightly better.

FINAL COMMENT

You have likely noticed that Betty Jane could hear no difference between the two amplifiers. In fact, she was incredulous that I claimed to hear some slight differences! And I cannot be certain about the differences I have listed, because they are so very subtle.

All the effects noted were very slight, and would not have been found without the ability to A/B two sources. Even with that ability, the two amplifiers sound so alike that comparisons were difficult. What this means is that the HA-2 is an excellent amplifier, quite neutral and uncolored, and adds almost no discernible artifacts (hum, noise, distortion) to the music.

In fact, most engineers who have studied the comparison between the vacuum-tube sound and the solid-state sound agree that real differences show up only when the active devices are overdriven, assuming good design. Overdriven ICs sound horrible. Overdriven discrete transistors can be less objectionable, depending upon the implementation of negative feedback. Overdriven vacuum tubes are much more sonically pleasing.

We did not test either amplifier while overdriving it because we value our hearing. Without the whole-body clues that are available during non-headphone listening, it is quite easy to turn headphones up to damaging levels unintentionally.

The bottom line, in our opinion, is that you should carefully evaluate the combination of your headphones and any headphone amplifier you may purchase, and then buy the one that sounds good to you. For quality construction and excellent performance in a well-designed vacuum-tube unit, the Wheatfield HA-2 certainly deserves serious consideration.